Emergent endovascular treatment of a bleeding recurrent aortoenteric fistula as a "bridge" to definitive surgical repair

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We report the case of a 59-year-old man who developed a recurrent aortoenteric fistula (AEF) following previous aorto-bifemoral bypass grafting and subsequent AEF open repair with aorto-bifemoral graft excision and extra-anatomic reconstruction. The patient was treated emergently by means of endovascular plug deployment via a left brachial approach into the infrarenal aortic stump, obtaining recovery of hemodynamic stability. Five days later, he underwent elective relaparotomy, aortic plug removal, infrarenal aortic ligature, and duodenal repair. Endovascular strategies to rapidly stop bleeding associated with recurrent AEF may serve as a "bridge" to definitive open repair, as in the case discussed herein. Even if rare, recurrent AEF following previous prosthetic aortic graft excision and extra-anatomic revascularization represents a dreadful event. Since surgical treatment is technically demanding and time consuming in emergent settings, we present an "unconventional" endovascular option to obtain quick cessation of aortic bleeding. (J Vasc Surg 2012;55:1160-3.)

A 59-year-old man was admitted at the Emergency Department of our Institution for abdominal pain lasting for 4 days. He had history of left nephrectomy 21 years earlier. He had also undergone an aorto-bifemoral bypass graft for aorto-iliac occlusive disease, with an end-to-side proximal anastomosis about 3 cm below the renal arteries 13 years earlier. After that, he developed a fistula between the aortic anastomosis and the duodenum that was treated 9 years earlier by means of aorto-bifemoral graft excision, primary duodenal repair, and right axillo-bifemoral bypass grafting. During this operation, the infrarenal aorta was clamped, the graft was excised, and the aortic wall was simply sutured, leaving the distal aorta with its chronically atherosclerotic occlusion. On admission, contrast-enhanced computed tomography (CT) scan of the abdomen showed a periaortic collection, with air bubbles surrounding the infrarenal aorta, very close to the third part of the duodenum; of note, an aortic segment of about 3 cm below the right renal artery was patent (Fig 1, *A*). A few hours after admission in the emergency room, the patient presented with episodes of hematemesis and melena and developed sudden hemorrhagic shock. He was immediately transferred to the operating room equipped with a portable C-arm image intensifier.

Via a left brachial surgical approach, a standard 0.035" steerable guidewire (Storq, Cordis Corporation, Miami Lakes, Fla) was carefully advanced into the abdominal aorta, until the origin of the renal arteries. Bone markers (limiting lines of the lumbar vertebrae) observed on preoperative CT scan reconstructions helped us to accurately identify the target aortic level, avoiding accidental perforation of the infrarenal aorta by the guidewire tip. Then, a 9-Fr hydrophilic introducer sheath (Cook Medical Inc, Bloomington, Ind) was advanced into the juxtarenal aorta, and diagnostic angiography was performed. Once the distal end of the sheath was advanced until the distal edge of the segment to be occluded, the guidewire was removed, and a 18-mm endovascular plug (Amplatzer Plug II; AGA, Plymouth, Minn) was inserted into the introducer sheath and pushed into the target site through its 135-cm delivery wire. Deployment was then obtained by simply withdrawing the introducer sheath, and the plug was finally released by rotating the delivery wire counterclockwise. Operative time of the endovascular procedure from the start of the operation to plug placement was 25 minutes. Significant cessation of blood flow into the infrarenal stump was observed at completion angiography performed about 10 minutes after plug deployment.

The intraoperative course was uneventful, and no episodes of hematemesis or melena were observed in the following 3 days. The patient received blood and plasma transfusions, broad-spectrum antibiotics, parenteral nutrition, and bowel preparation. A CT scan showed the vascular plug to be deployed at the intended site, with infrarenal aortic occlusion and likely reduction of residual periaortic collection (Figs 1, *B* and 2). An esophagogastroduodenoscopy was performed that excluded an active upper gastrointestinal bleeding.

On postoperative day 5, after full recovery of good clinical conditions, the patient underwent elective relaparotomy. The aorta was exposed after left renal vein division, in order to obtain an adequate clamping site just below the

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Fig 1. A, Multiplanar reconstruction of preoperative computed tomography (CT) scan (*top*), showing abdominal aortic occlusion, with a residual patent 3-cm-long infrarenal aortic stump. Of note, left infrarenal periaortic collection (*asterisk*) and a patent right lumbar artery (*white arrow*). On axial image (*bottom*), an air bubble surrounding the aorta is evident (*black arrow*). **B**, After deployment of a 18-mm Amplatzer Plug II (*top; black arrow*) into the infrarenal aortic stump, CT scan shows thrombosis of the aorta just below the origin of the right renal artery. Also, periaortic collection is less evident (*bottom*).

Fig 2. Three-dimensional reconstruction of the postprocedural computed tomography (CT) scan, showing infrarenal aortic occlusion by the endovascular plug, in order to obtain cessation of bleeding associated with recurrent aortoenteric fistula (AEF). Of note, patent right axillo-bifemoral bypass graft.

renal arteries. The endovascular plug was found with the distal end completely protruding outside the aortic anterior wall, being, however, fully hemostatic (Fig 3, *A*). After infrarenal cross-clamping, the plug was removed. The aorta was then oversewn just below the origin of the renal arteries (about 2 cm above the level of previous plug deployment) by means of a polypropylene double-layer suture. A 2-cm single perforation of the third part of the duodenum was found and repaired via simple duodenorraphy with omentoplasty (Fig 3, *B* and *C*). Total operative time was 3 hours and 35 minutes; the time needed to gain aortic control from the start of the operation was about 90 minutes. The patient did well and was discharged on postoperative day 14 on oral antibiotics, indefinitely.

DISCUSSION

Aortoenteric fistulas (AEFs) are associated with high mortality rates, even if promptly recognized and treated.[1,2] Their recurrence is rare but represents a highly lethal event, and no consensus exists about its management.[3] Conservative treatment has been shown to invariably result in death.[1] Open surgery presents several technical challenges, including difficult aortic exposure due to strong postsurgi-

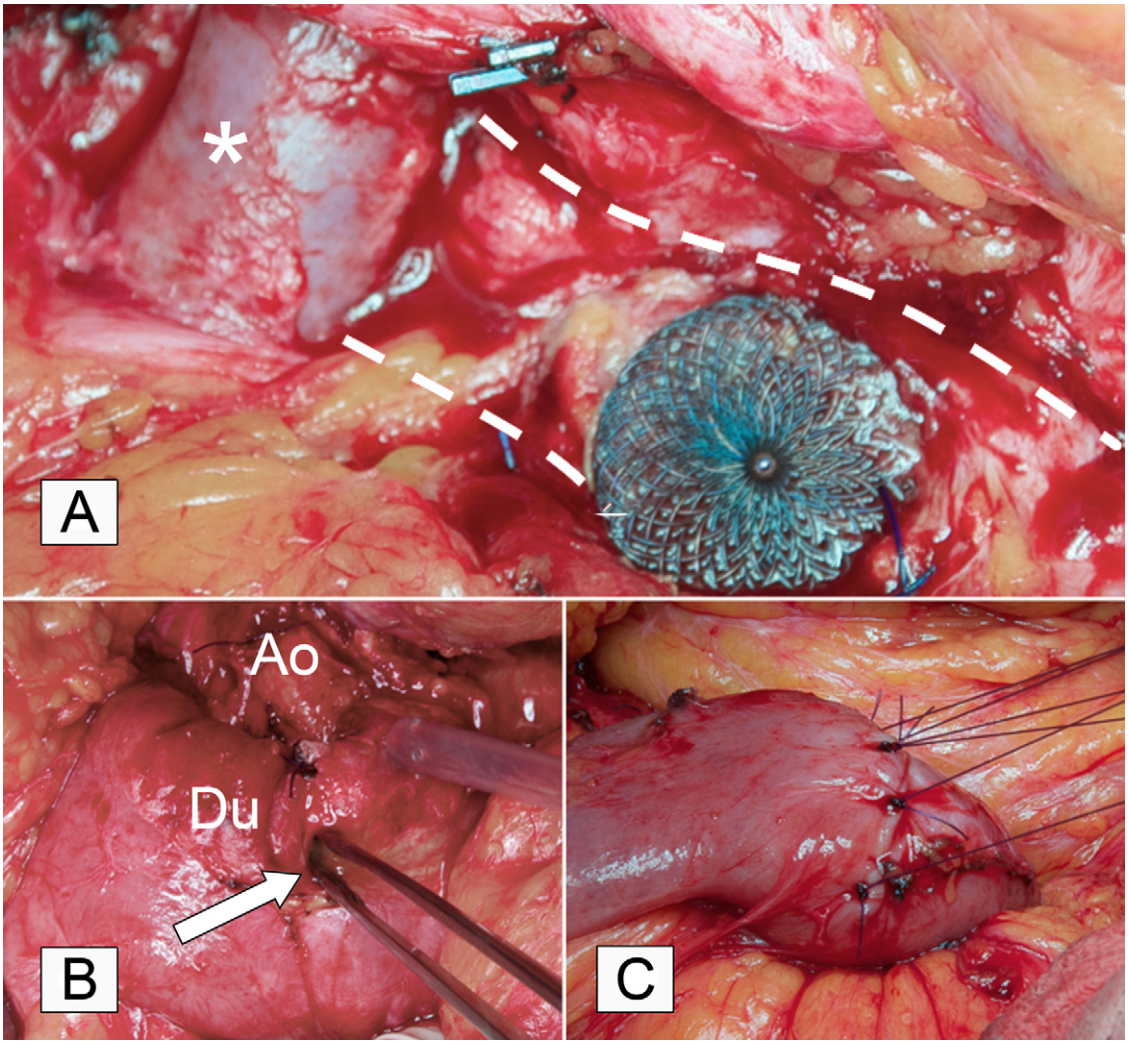

Fig 3. Intraoperative photographs during open surgical conversion for recurrent aortoenteric fistula (AEF). **A**, The left renal vein (*asterisk*) and the infrarenal aorta (*dashed lines*) are exposed, discovering protrusion of the distal part of the endovascular plug outside the aortic wall. **B**, A 2-cm single duodenal transmural lesion (*white arrow*) is found. **C**, The lesion is repaired by means of simple duodenorrhaphy.

cal adhesions and poor infrarenal aortic control, often requiring supraceliac clamping. Especially in cases of recurrent AEF, obtaining proximal aortic control may be time consuming in hemodynamically unstable patients. Even if different strategies are described for vascular reconstruction in cases of AEF, including in situ bypass grafting with homografts[4] or silver-coated prostheses,[5] extra-anatomic revascularization remains the most viable option in cases of recurrent AEF.[1,2,6]

Endovascular treatment by means of aortic stent-grafting (EVAR) has been shown to be effective to rapidly stop bleeding associated with AEF in unstable patients, but it has been referred to by most authors as a "bridge procedure" to definitive surgical repair.[7] EVAR has the obvious advantages to allow quick resolution of acute bleeding, avoid supraceliac aortic cross-clamping, reduce surgical time, and eliminate the risk of abdominal organs accidental lesions. However, standard EVAR is not anatomically feasible in patients with infrarenal aortic occlusion and in cases of recurrent AEF (following previous aortic ligation) as in the case presented.

Several endovascular occluders/plugs are commercially available at present. They all allow endovascular occlusion of a patent arterial vessel by means of clot formation. They are commonly used by vascular surgeons or interventional radiologists to occlude collateral branches in cases of abdominal and thoracic aortic stent grafting.[8-10] Also, the use of endovascular plugs in emergency to control hemorrhage from ruptured aortic, iliac, hypogastric, visceral, and peripheral aneurysms has been anecdotically reported, with some encouraging clinical results.[11,12] To the best of our knowledge, the use of an endovascular plug to emergently

occlude the infrarenal aorta in cases of a bleeding recurrent AEF has never been reported in the English literature.

In our experience, this "unconventional" approach easily provided prompt resolution of bleeding associated with the AEF. The procedure may be carried out under local anesthesia, through a percutaneous or surgical brachial or axillary vascular access. The choice to use an Amplatzer vascular plug must take into account that this device typically does not provide immediate cessation of blood flow, as compared with other endovascular devices (ie, covered iliac plugs). However, we used this plug because it allowed us to easily reach the deployment site from a brachial access (thanks to its 135-cm delivery wire). Unfortunately, most commercially available covered iliac plugs are provided with a 50-cm to 70-cm delivery shaft, and it would have been impossible to use them in this particular case. Although endovascular aortic occlusion may be successfully accomplished, our opinion is that it must be regarded as a "stop-gap" procedure. As a matter of fact, poor long-term results of endovascular treatment are described in cases of aortic fistulae, due to high reinfection rates. Burks et al reported a 43% rate of sepsis persistence or recurrence after endovascular repair of abdominal AEF.[13] We recently observed similar results during follow-up after thoracic endovascular repair for aortoesophageal and aortobronchial fistulae.[14]

In this case, once the patient was stabilized, elective surgical repair of the recurrent AEF was performed by means of infrarenal aortic ligation and duodenal repair. Initial success of endovascular treatment allowed us to wait 5 days before open surgical conversion, in order to achieve the patient's best hemodynamic conditions, submit him to blood and plasma transfusions and complete bowel preparation.

Of note, during open conversion, we found the distal end of the endovascular plug protruding outside the aortic wall. This finding is consistent with our feeling that, anyway, definitive open repair of the fistula must always be offered to stable patients with good life expectancy, even if the endovascular procedure seems to have "solved the problem."

CONCLUSIONS

This is the first report of emergent treatment of a recurrent AEF by means of endovascular plug deployment into the infrarenal aorta from a remote access. In our experience, this strategy represented a successful "bridge solution" to definitive surgery in an anatomically suitable and hemodynamically unstable patient.

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